Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of	)	
	)	
Preserving the Open Internet	)	GN Docket No. 09-191
	)	
Broadband Industry Practices	)	WC Docket No. 07-52

COMMENTS OF ERICSSON INC

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SUMMARY

Ericsson's comments focus on the importance of: Network Management—to achieve network efficiency and the appropriate allocation of capacity; and Managed Services—which deliver consumers valuable services and enable providers to earn a return on their network investments.

As a threshold matter, the Commission does not need to codify either the original four principles set forth in the Commission's *Internet Policy Statement* or any additional rules to protect consumers and the vibrancy of the broadband ecosystem. This is true for all networks, but especially for wireless networks.

Wireless Networks Are Unique. Wireless networks face special challenges that are not applicable to other access technologies:

- Spectrum is a fundamental enabler for wireless networks. The ability of wireless technologies to deliver high data rates largely depends on the amount of spectrum available for use. However, not only is access to spectrum limited but there are also RF engineering constraints associated with using spectrum as a delivery platform;
- The wireless market is highly competitive with more than 95% of Americans having a choice of three or more wireless providers. These providers offer consumers the added advantage of mobility to their broadband services;
- As the demand for mobile broadband services explodes, sustainable business models ensure continued investment and dynamic competition in wireless networks. To address this business reality, wireless providers need the maximum flexibility to manage their networks to deliver revenue generating services; and
- Timely availability of suitable spectrum is key to the continued growth of mobile broadband.

Network Management Is Essential. Network management is so integrated into the fabric of network performance and optimization that Ericsson urges the Commission to find that all network management is *presumptively* reasonable, especially those practices that are standardized or widely used by network operators. Specifically:

- Network management mediates the constant contention for resources. It is central to the operation, interoperability, and performance of broadband equipment, applications, and services in all networks;
- Even as network technologies become more advanced, network management will continue to be needed because consumers will *always* require more capacity for new and exciting interactive multimedia applications and services; and
- From a business perspective, network management is critical to reducing costs, optimizing networks, and creating valuable services for consumers that address the Quality of Service ("QoS") requirements for applications sensitive to packet loss, packet delay, or jitter.

To resolve allegations of unreasonable network management practices, the Commission should, on a case-by-case basis, consider whether the challenged practices have: (1) significantly harmed consumers; and (2) had significant anticompetitive effects. This approach takes into account the engineering realities of networks—that resources must be allocated according to a particular scheme to distribute capacity to all users—and provides the Commission with an appropriate level of oversight to protect the public interest.

Managed Services, Free of Regulation, Are Also Essential. The Commission should not regulate managed services. Providers must be able to offer managed services, *e.g.*, IP services that are managed to provide a specific QoS because:

- Ensuring that providers can offer managed services allows application developers to create new and innovative applications that benefit from—or specifically require—guarantees of service, quality, security, or integrity;
- Managed services preserve providers' ability to meet consumers' quality expectations of "traditional" managed offerings (such as television and two-way voice calling) in an all-IP network;
- Managed services ensure that providers, who invest billions of dollars in networks, have an opportunity to innovate and earn a return on their investment; and
- Managed service arrangements of all kinds are providing increasing value to consumers. There are multiple mechanisms for providing managed services and the Commission should allow consumers to drive the innovation and implementation of new offerings.

The Commission should find that managed service offerings are presumptively permissible and not limit them, unless and until the service is shown to significantly harm consumers and have significant anticompetitive effects.

The industry requires business models that can sustain the broadband ecosystem. To continue investing in research and development as well as network infrastructure, access providers and service providers, alike, must continue to utilize network management tools that enable both broadband Internet access and managed services. The foregoing approaches address this reality and best achieve the Commission's goals of preserving investment and innovation in broadband networks and providing all members of the broadband and Internet ecosystem greater clarity, predictability, and flexibility.

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Ericsson Inc ("Ericsson") submits these comments in response to the Federal Communications Commission's ("Commission") Notice of Proposed Rulemaking seeking input on the best means of preserving a free and open Internet.[1] In this *NPRM*, the Commission seeks to create a balanced framework that gives providers of Internet access, content, and applications and their customers the clarity and flexibility needed to support continued innovation and investment in broadband networks and technologies.

Ericsson fully supports the Commission's goal to maximize the potential of broadband networks and the Internet and to provide greater predictability to all members of the broadband ecosystem. In addition, Ericsson supports the Commission's efforts to help industry address emerging challenges to broadband networks, such as the explosion of data traffic. However, Ericsson does not believe that either the four principles set forth in the Commission's *Internet Policy Statement*[2] or the proposed "nondiscrimination" or "transparency" rules need to be codi-

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[1] *Preserving the Open Internet; Broadband Industry Practices*, GN Docket 09-191 & WC Docket 07-52, *Notice of Proposed Rulemaking*, FCC 09-93 (Oct. 22, 2009) ("*NPRM*").

[2] *Appropriate Framework for Broadband Access to the Internet*, CC Docket 02-33 *et al.*, *Policy Statement*, 20 F.C.C.R. 14986, 14987–88 (2005) ("*Internet Policy Statement*").

fied to make this goal a reality.[3] On the contrary, such rules could impede providers' ability to deliver broadband services to consumers. Such rules would be particularly onerous for wireless networks, which are capacity constrained by the finite spectrum resources available and require a plethora of management techniques in order to ensure a quality experience for subscribers at large. Rather than adopting new rules, Ericsson recommends that the Commission's guidance be limited to what Ericsson proposes herein, specifically, that network management practices are presumed reasonable and that managed services are not subject to either the *Internet Policy Statement* principles or other rules.[4]

Network management is essential to the functioning of any network, and especially the complex global network of networks that is the Internet. Network management is also critical to a sustainable business model for broadband deployment, applications, and services. Therefore, in all events, whether the Commission adopts rules or retains general principles, it should make clear that all of its open Internet policies are subject to an exception for reasonable network management. To date, the Commission has not adequately described what network management practices are "reasonable."[5] Accordingly, Ericsson proposes that the Commission make clear

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3 Given the technical focus of these comments, Ericsson does not address legal issues relating to the extent of the Commission's authority and jurisdiction. Consequently, Ericsson's comments apply only to the extent the Commission has both jurisdiction and authority to impose mandatory and enforceable regulatory requirements on broadband Internet access providers.

4 One reason Ericsson concludes that no rules are needed is that to date the Commission has only taken enforcement action to address network neutrality issues in two cases, a 2005 case involving Madison River Communications and a 2008 case involving Comcast. *See NPRM* at ¶ 32 (citing *Madison River Communications,* File No. EB-05-IH-0110, *Order,* 20 F.C.C.R. 4295 (EB 2005)), ¶¶ 36-37 (citing *Free Press v. Comcast Corp.*, WC Docket 07-52, *Memorandum Opinion and Order,* 23 F.C.C.R. 13028 (2008), *subsequent history omitted*). Two isolated instances do not reflect a problem so pervasive such that regulatory intervention is needed to protect consumers or the broadband ecosystem.

5 In its *NPRM*, the Commission defines "reasonable network management" in a circular manner to include "reasonable practices" to achieve certain specific objectives and "other reasonable network management practices." *NPRM* at ¶ 135. The Commission's subsequent dis-

(continued on next page)

that: (a) all network management practices will presumptively be considered reasonable, especially those that are standardized or widely used; and (b) the party claiming that a network management practice is unreasonable must show, at a minimum, that it has caused significant harm to consumers and has had a significant anticompetitive effect.[6]

In addition, Ericsson urges the Commission to confirm that managed services are not subject to the rules and policies that the Commission applies to broadband Internet access.[7] Providers' ability to offer managed services, without the uncertainty of potential new regulations, is critical to their ability to earn a return on their significant broadband network investments. Moreover, managed service arrangements hold distinct value for consumers. For these reasons, the Commission should refrain from applying either its *Internet Policy Statement* principles or other rules to managed services because doing so may hinder their evolution and is not in the public interest.

INTRODUCTION

Ericsson's Engineering Experience. Broadband networks are extremely complex and dynamic. Innovation and technology evolution is taking place, across a wide variety of access

(footnote continued)
cussion acknowledges that what is "reasonable" will depend on a multitude of factors, many not even known to the Commission. *Id.* at ¶¶ 137, 140.

6 In determining whether conduct significantly harms consumers or has a significant anticompetitive effect, Ericsson suggests that the Commission rely on well established precedent rather than create any new test. Accordingly, activities that harm consumers in the aggregate would be those that are inconsistent with the policy mandates that the Commission is responsible for carrying out under the Communications Act. Activities that have an anticompetitive effect would include conduct that violates strict antitrust precedent and conduct violating established Commission competition policies.

7 Outside of this proceeding, Ericsson uses the term "Managed Services" to refer to its management of the operations of networks. Herein, consistent with the Commission's approach, Ericsson uses the term "managed services" to mean applications and content that are delivered to end users with some different degree of control over QoS than that which applies generally to IP-delivered traffic.

platforms, at every level of and entry point into the many broadband networks that make up the Internet. Ericsson knows this because it has been engineering fixed and mobile technologies for over 130 years and its products are implemented in communications networks in 175 countries. Ericsson also has special expertise in the products that optimize network performance and permit providers to deliver reliable communications. For example, Ericsson is a leading innovator and driver of Long-Term Evolution ("LTE"), a standardized 4G wireless technology that builds on the success of GSM and offers a richer mobile broadband experience. LTE will deliver extremely high performance wireless networks (ultimately, in excess of 100 Mbps), which will support wireless multimedia applications and services.[8]

Ericsson has also heavily contributed to the development and standardization of Internet Protocol ("IP") Multimedia Subsystem ("IMS"), a framework for delivering IP multimedia services across access platforms. IMS relies on a collection of standardized interfaces throughout

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[8] Verizon Wireless plans to deploy LTE covering 25 to 30 markets in 2010 and by 2013 will extend LTE coverage to nearly all of its 3G network. As a result, its wireless network will bring consumers ubiquitous wireless broadband connectivity and mobility. *See* Verizon Press Release, *Verizon Wireless Updates Specifications For 4G LTE 700 MHz Devices* (Dec. 21, 2009), *available at* http://news.vzw.com/news/2009/12/pr2009-12-21a.html; Verizon Wireless Press Release, *Leading 4G Network Build, Verizon Wireless Also Focuses on Fueling LTE Ecosystem, Collaboration,* (Nov. 4, 2009), *available at* http://news.vzw.com/news/2009/11/pr2009-11-04b.html. Scandinavian network operator TeliaSonera recently launched the world's first commercial LTE service in Stockholm, Sweden and Oslo, Norway. Roger Field, *TeliaSonera launches first commercial LTE networks* (Dec. 29, 2009), http://www.itp.net/578702-teliasonera-launches-first-commercial-lte-networks. The new service will provide customers with a real-world download speed of 20-80 Mbps, and throughput will be capped at 30 GB after an initial period. David Meyer, ZDNet UK, *First '4G' Services Go Live in Norway, Sweden* (Dec. 14, 2009), http://news.zdnet.co.uk/communications/0,1000000085,39936974,00.htm; *see also* Tara Seals, VON, *Gearmakers Square Off as LTE Market Heats Up* (Dec. 17, 2009), http://www.von.com/news/gearmakers-square-off-as-lte-market-heats-up.html; Carl Ford, TMCNet, *4G Wireless Evolution—Bleeding at the Edge of LTE* (Dec. 23, 2009), http://4g-wirelessevolution.tmcnet.com/topics/4g-wirelessevolution/articles/71572-bleeding-the-edge-lte.htm; *Teliasonera Launches First LTE in Stockholm and Oslo*, CONVERGE! NETWORK DIGEST (Dec. 14, 2009), http://www.convergedigest.com/Wireless/broadbandwirelessarticle.asp?ID=29196; *see also* TeliaSonera 4G, http://www.teliasonera.com/4g/index.htm (last visited Dec. 28, 2009).

the network subsystem to enhance the integration of wired and wireless networks and simplify the delivery of services. Further, IMS facilitates the full and efficient utilization of network resources.

Ericsson also has significant networking expertise. As well as a broad range of wireless technologies including LTE, HSPA, and CDMA, Ericsson designs, develops, builds and operates highly versatile IP networks for residential and business broadband service delivery. For example, Ericsson has deployed a specialized Broadband Remote Access Server (BRAS) that addresses the scalability of residential broadband. Ericsson also pioneered the use of a point-to-point protocol to encapsulate residential broadband services and enable automated per user identification, authentication, dynamic policy enforcement, and automated provisioning of residential broadband services. Ericsson's advanced service gateway innovations support both mobile and fixed broadband services simultaneously. This capability drives the convergence of fixed and mobile broadband by allowing users to access consistent broadband services regardless of how they are connected to the network (either over mobile broadband of fixed broadband) and to move seamlessly between the two.

In addition to developing the technologies that enable providers to deploy enhanced networks, Ericsson also offers a comprehensive portfolio of services, including network roll-out, deployment, and operation.[9] These services help providers manage complex multi-vendor and multi-technology network environments. They also enable providers to concentrate on their core business of providing service to consumers.

[9] These management services involve the management of the operations of providers' telecommunications and information networks, not Ericsson branded offerings of "managed" IP telecommunications services, such as IPTV or managed VoIP. *See also supra* note 7.

Since 2002, Ericsson has announced more than 100 contracts for network management (*i.e.* network operation) services with network operators worldwide. Just this past summer, Ericsson announced a network services agreement involving day-to-day services, provisioning, and maintenance for Sprint's CDMA, iDEN and wireline networks.[10] In total, Ericsson is managing networks that serve more than 350 million subscribers around the world.[11] As a result of this expertise, Ericsson has gained a keen global insight into the challenges providers face in optimizing network performance to meet customer needs and business requirements.

Ericsson also engineers and implements a broad array of network management tools for many different platforms. These management tools are largely standardized through open and participatory industry-sanctioned processes that are adopted and implemented on a global scale. They permit interoperability and are critical to the appropriate allocation of network capacity and efficient operation of networks.

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[10] *See* Sprint News Release, *Sprint Gains Network Advantage: Innovative Network Services Deal with Ericsson Delivers Competitive Edge* (Jul. 9, 2009), *available at* http://newsreleases.sprint.com/phoenix.zhtml?c=127149&p=irol-newsArticle_newsroom&ID=1306123. Although Ericsson provides the day-to-day support of Sprint's CDMA, iDEN, and wireline networks, these networks remain under Sprint's ultimate supervision and control.

[11] *See* Ericsson News Release, *Ericsson Reports Third Quarter Growth* (Oct. 22, 2009), http://www.ericsson.com/ericsson/investors/financial_reports/2009/9month09.shtml ("The total number of subscribers in managed operations is now 350 million, of which 50% are in high-growth markets.").

DISCUSSION

I. NETWORK MANAGEMENT IS INTEGRAL TO THE USER EXPERIENCE AND EFFECTIVE UTILIZATION OF NETWORK RESOURCES

A. Overview

In its *Internet Policy Statement*, the Commission recognized that its four network neutrality principles needed to be subject to "reasonable network management."[12] The Commission made the same observation about the proposed "nondiscrimination" or "transparency" rules in the *NPRM*.[13] Whether or not the Commission codifies these principles and/or any additional principles, the Commission must ensure that these concepts remain subject to reasonable network management.[14] This is because network management, which includes distinguishing among different types of traffic in a network, is essential both for delivering a quality experience for all users and for ensuring that network resources are efficiently utilized.

Today, in all networks, certain kinds of traffic are differentiated and prioritized over others for legitimate, service quality reasons. Some "discrimination" is entirely valid and is needed to make networks function effectively. For example, voice is prioritized over all other traffic because it requires a constant bit rate connection in order for users to understand each other. In the absence of this differentiation and prioritization, all voice users would experience suboptimal service.[15]

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12 *See Internet Policy Statement,* 20 F.C.C.R. at 14988 n.15.

13 *See NPRM* at ¶ 11.

14 As noted above, Ericsson does not support the codification of either the original four principles or any additional principles because such rules are not necessary to protect consumers and the vibrancy of the broadband ecosystem.

15 Although all users would indeed be treated "equally" and "nondiscriminatorily"—they would also be uniformly dissatisfied with their communications experiences.

Access to network resources, or capacity, is contention-based. All networks, but particularly shared networks, suffer from "traffic collapse"—a phenomenon that occurs when networks are overloaded and traffic reaches a critical level of saturation. At that point, any further congestion at critical nodes brings the network throughput to a standstill, just as traffic on a saturated highway will be moving along but then come to a screeching halt.[16] Networks need some organized way of allocating resources among the users seeking it in order to avoid instances of traffic collapse. Network management provides this resource allocation structure and takes into account both the needs of users and the operational parameters of the network at the precise time a service request is made.

Multiple network management techniques are in use at all times in communications networks—just as in highway networks—and they are critical to a satisfactory consumer experience. They typically operate in micro- and millisecond time frames. Without network management, network performance is not optimized and users experience instances of degraded service caused by packet loss, packet delay (latency), and jitter—problems that are more prevalent when networks are congested.

Packet loss, latency, and jitter are the enemies of a quality communications experience, which is the basis of value for consumers. Networks are primarily managed to prevent (or minimize) these events. Packet loss occurs when oversaturated network elements drop packets. Often, this causes the receiver to request re-transmission and contributes to greater congestion. Latency refers to delays in packet delivery due to distance and queuing. Jitter refers to variable latency caused by queuing.

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[16] *See, e.g.,* MARTIN NEMZOW, FAST ETHERNET IMPLEMENTATION AND MIGRATION SOLUTIONS 12 (McGraw-Hill 1997); WILLIAM STALLINGS, DATA AND COMPUTER COMMUNICATIONS 275 (MacMillan 1988).

Even the most optimized network may experience instances of congestion that cause service interruptions related to packet loss, latency, and jitter. This is because consumer demand is intrinsically unpredictable, especially in the mobile environment. Even the best models cannot account for changing consumer behavior, evolving consumer demands, and external events, such as game-changing innovations.

In addition, network capacity is limited by the physical capabilities of the equipment deployed. Some networks, such as wireless networks, are more capacity constrained than others. Wireless networks rely on finite spectrum resources, access to which is controlled by the government through spectrum allocations and auctions, and those spectrum resources have inherent RF engineering limitations. However, network management is needed in *all* networks (albeit to a lesser or greater extent depending on the access technology) to minimize packet loss, latency, and jitter and improve the overall utilization and performance of the network.

As broadband traffic grows, there will be increased pressure on all network resources. Providers will need to continue to manage the allocation of network resources to ensure consumers have a quality communications experience. Ericsson and others will certainly engineer new technologies and solutions to help address growing demand. Nevertheless, network management tools will remain critical to achieving optimal network performance for the foreseeable future. Moreover, these technologies and solutions will likely be broadly implemented worldwide, as they are today. Thus, it is important that industry practices and standardized technologies be protected from regulations that impose special conditions on their functionality or use, and that could have a world wide impact on their development, manufacture, availability, cost, and implementation.

As discussed below, Ericsson urges the Commission to find that all network management tools are presumptively reasonable—especially those that are standardized or widely employed in a variety of networks. A specific management practice should be deemed unreasonable only if it significantly harms consumers and has significant anticompetitive effects.

B. Network Management Techniques Are Widely Used in All Networks

For some time, network management has been unfairly cast by some as a collection of dangerous and devious tools that allow bad actors to manipulate networks and implement self-serving agendas. The reality is much more banal, but no less important. Network management makes things *run*. These tools are in use in all networks around the globe, all the time, and at all levels to facilitate the transfer of information. Network management tools address the constant contention for network resources, allocate capacity, minimize congestion, and compensate for engineering realities such as interference or signal loss, to name a few of their important functions. Network management tools are the functional equivalent of highway speed limits, traffic signals, high occupancy and bus lanes, and commercial-traffic restrictions.

Management techniques range widely in both complexity and implementation level. At the outset, network management begins with network planning and design. In configuring networks, Providers look to achieve the maximum efficiency in the highest use areas. Often, capacity and coverage considerations are in tension and one component is emphasized over the other for a variety of complicated but important reasons. Sometimes there are physical/engineering barriers, other times there are requirements affecting the viability of a network provider's business model or its ability to fund the ideal dimensioning of the network.

How a network is designed and deployed is the initial management tool that all providers use. Historically, over-provisioning of IP network resources was used to provide an average quality of service. However, over-provisioning is not a particularly sophisticated management tool and is only possible when there is spare capacity available to over-provision.

Deploying more equipment to add capacity is not always practicable. As noted above, not only are there capital and business constraints to this strategy but also engineering constraints. For wireless networks, the challenges are especially profound because capacity is limited by the amount of spectrum available and its RF characteristics, factors not within the control of wireless providers.[17] Even in the absence of these limitations, adding capacity does not eliminate the need for network management to optimize operation and resource utilization, for the benefit of all.

Today, multiple management techniques are widely employed to improve traffic flow, combat congestion, and deliver services. These management techniques are largely standardized, so their propriety and suitability have been reviewed by technical experts from a broad cross section of the industry. Some of these tools, such as schedulers, are automatic and are built into networks at their most fundamental level; they operate at the subconscious or "heartbeat" level of networks to manage resource allocations. Others, like packet analysis, are more dynamic and more intelligently manage traffic flow. Without these, and other, network management tools, networks could not support the numerous applications and services essential to daily living and commerce.

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17 *See, e.g.*, Comments of CTIA – The Wireless Association®, GN Docket 09-47 *et al.*, at 2 (Oct. 23, 2009) (noting that "current spectrum allocations are insufficient to meet the growing demand for wireless broadband services."); Comments of T-Mobile, Inc., GN Docket 09-47 *et al.*, at 12 (Oct. 23, 2009) (noting that "the only way to close the spectrum gap between available commercial spectrum and expected consumer demand is for the Commission to license more spectrum as quickly as possible."); *see also* Sue Marek, *Solving Network Capacity Issues Should Be No. 1 Priority for 2010* (Dec. 18, 2009), http://www.fiercewireless.com/story/solving-network-capacity-issues-should-be-no-1-priority-2010/2009-12-18.

The following sections describe some network management tools that are used, to varying degrees, in all communications networks to manage the transmission of information. These management techniques, as well as numerous others, are what allow consumers to *actually* communicate—establish and maintain a communications session to interact and exchange information with another person or with an application server. They are important, pragmatic tools for ensuring that each person in the user pool has access to the network capacity, and are essential to the functioning of the Internet.

1. Schedulers

A scheduler is a complex algorithm that gives communications flows access to network resources and balances the overall load on a network according to a defined scheme. Schedulers make decisions about resource allocation at the microsecond level. In communications and data networks there are at least six different scheduling schemes in use:

- ***Round-robin queuing*** is a simple "best efforts" algorithm that assigns equal intervals to multiple data flows in rotation, without any prioritization.
- ***Fair queuing*** takes packet size into account and seeks to equalize data flows.
- ***Weighted fair queuing*** allows the assignment of priorities to data flows.
- ***Proportionally fair queuing*** is a variant on weighted fair queuing that assigns priority inversely proportional to the "cost", in terms of the network resources needed, of transporting a data flow.
- ***Maximum throughput scheduling*** gives the highest priority to the least "costly" data flow so as to maximize overall data throughput.
- ***Equal rate scheduling*** allocates throughput at a rate equal to the allocated rate of the corresponding session.

These scheduling techniques all have appropriate uses to allocate resources and balance traffic flow. Once one is implemented in the network, it generally applies to all network users in the same way. Which one is appropriate for a given network involves engineering trade-offs that take into account how the network operates. Thus, although schedulers are used in both wired and wireless networks, different networks may benefit more from a particular scheduler depending on the underlying access technology.

For example, in cable networks, schedulers are typically set to deliver best efforts service using "round robin" queuing. To transmit data in a cable network, users must request a grant token(s), or permission to transmit, from the scheduler and the cable modem termination system located at the headend. The scheduler hands out time slots in response to these requests on a first come, first served basis.

Most cable networks utilize best efforts-based queuing because network capacity is shared among many users (typically 100-200 modems must share one upstream channel) and best effort-based queuing puts all users on an equal footing when contending for network resources.[18] This scheduling scheme has some advantages, but its use impacts the ability for providers to deliver application-specific Quality QoS.[19]

In wireless networks, schedulers help manage the distribution of finite capacity and variances in signal quality resulting from mobility conditions, such as proximity to a cell site and interference. In wireless networks, addressing these variances is complex because, for a given cell

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[18] When demand for capacity is high, management tools can step in to allocate time slots, and thereby limit throughput or speed temporarily. Generally, this is achieved by using a "throttling" technique. Throttling has a very legitimate and useful purpose—it provides a standardized way of limiting the upstream transmission rate, which can be especially important in cable networks where a single upstream channel is multiplexed among a large number of users and a single user seeking high throughput can occupy all, or nearly all, of the available capacity.

[19] To add reliable QoS for voice over IP services, the CableLabs PacketCable specification includes a method to reserve bandwidth for the duration of a call. At the media access control layer, the DOCSIS unsolicited grant service is used to allocate a fixed number of time-slots per second at a higher priority than best-effort data to ensure a peak in data traffic does not interfere with the call.

site, each user simultaneously vies for all or part of the available capacity but each has different reception characteristics that can impact performance not only for that user, but also for others attempting to utilize the same cell site. Selecting one scheduler over another allows providers to balance overall system spectral efficiency with user satisfaction considerations.

For example, a "maximum throughput" scheduling algorithm may achieve the best spectrum efficiency because it gives the highest priority to the traffic flows that can be most efficiently served, to the exclusion of others. However, there is a distinct potential for a diminished experience for those users that aren't most efficiently served. Similarly, a strictly nondiscriminatory "round robin" algorithm could result in a diminished experience because the least efficient data flow (*i.e.*, the one most affected by interference) would be served with as much bandwidth as more efficient ones, causing slower throughput for most users. A "proportionally fair" scheduling algorithm allocates resources in a way that accounts for the RF characteristics of some users (*e.g.* those closer to the cell) with those of others (*e.g.* those at the cell edge).[20] Each of the foregoing approaches may have a valid purpose in different network environments. For this reason, the Commission should not restrict a provider's ability to choose one over the others.

2. Timers

Another important standardized management mechanism is a timer tool. Timers allow providers to establish a trigger idle interval that defines how the network should handle periods of inactivity during an active connection. Timers combat the unnecessary consumption of net-

[20] A proportionally fair scheduling algorithm assigns capacity to users with the best connections first, to move these users off the network faster and open the resources to other users who may need to be connected to the network longer because of their less favorable reception conditions.

work resources by terminating and tearing down a packet connection after a pre-set period of inactivity.

For example, if a user has an open data session that is idle for greater than 10 seconds, the timer tool will step in to release the session so that the network resources previously reserved for that session are returned to the capacity pool for other users. Although they arguably identify and diminish the experience of certain users, *e.g.* those who have hit the threshold idle interval, timers are yet another valuable tool for targeting inefficient resource allocations and spreading available capacity over a larger user group according to the actual needs of that group. Thus, timers can enhance the user experience overall while also improving network performance.

3. Other Network Management Tools

Other standard management tools, such as traffic shaping and packet analysis, are more sophisticated methods of optimizing network performance. These tools, like other management techniques, have been the subject of some scrutiny because of fears that they enable providers to single out some content or applications for special treatment.[21] However, these tools, like the others discussed above, are important methods for reducing latency and distributing network capacity more efficiently during periods of congestion.

For example, traffic shaping enables control over both the volume of traffic and the rate at which it is being sent through the network. Packet inspection provides information about the application using a particular IP flow. These tools enable providers to manage congested networks for the benefit of all users to deliver QoS, security, and data integrity and to improve network efficiency so that one heavy user does not shut down service to others. Accordingly, these

[21] As noted above, traffic differentiation and prioritization take place in the network today for very legitimate network performance and service quality reasons.

tools are important ways that providers can ensure that network resources are fairly distributed for the benefit of all users.

C. The Need to Manage Networks Will be More Acute as Broadband Adoption and Data Use Increases

It is universally recognized that data use will continue to grow at an extremely high rate, just as it has since broadband Internet access first became available to consumers nearly 10 years ago.[22] There are several interrelated factors at work multiplying demand and thereby causing the exponential growth in broadband consumption. The number of users continues to increase, as does the average user's time spent online.[23] The number of enhanced applications and services also continues to proliferate. And, applications seem to have ever-expanding demands for bandwidth:

> Popular applications such as mobile video are particularly data intensive. For example, watching a YouTube video on a mobile phone or laptop consumes almost one hundred times the data bandwidth of a voice conversation. Downloading a Microsoft PowerPoint file of five-megabyte (Mbyte) size to view it on an Internet device consumes the same amount of data on the downlink as speaking on a phone for more than an hour.[24]

Given the staggering growth to date and that is projected in the future, even with unlimited capital, providers simply *cannot* build capacity at the rate needed to keep pace with demand. This is true irrespective of access technology, but those technologies with inherent capacity constraints, such as wireless and cable networks, face special challenges. Consequently, going for-

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22 *See, e.g.*, Bret Swanson and George Gilder, ESTIMATING THE EXAFLOOD: THE IMPACT OF VIDEO AND RICH MEDIA ON THE INTERNET: A 'ZETTABYTE' BY 2015? Discovery Institute (Jan. 2008), *available at* http://www.discovery.org/scripts/viewDB/filesDB-download.php?command=download&id=1475.

23 *See* Rysavy Research, *Mobile Broadband Spectrum Demand*, at 6-11 (Dec. 2008) ("Rysavy Report"), *available at* http://www.rysavy.com/Articles/2008_12_Rysavy_Spectrum_Demand_.pdf.

24 Rysavy Report at 6.

ward, providers will need to rely more heavily on network management tools to allocate resources fairly during periods of congestion and deliver a satisfactory consumer experience.

1. Spectrum Is a Unique Constraint on Wireless Networks

Wireless networks are unique. Wireless networks are highly influenced by the radio environment, where the operating parameters are constantly changing. For example, the numbers of users, the level of interference, and the profile of data and voice traffic in a wireless network at a given time all contribute to how well the network functions from a capacity and coverage perspective. Similarly, the location of a user in a network also impacts propagation characteristics and can affect the user's perception of equipment and application performance. For these reasons, a significant amount of RF tuning and engineering expertise is needed to provide even basic communications services.

Today, consumers want much more than basic communications services. As noted above, the demand for mobile broadband is growing dramatically; consumers' appetites for feature rich, capacity intensive mobile broadband services seem to be insatiable. The ability of wireless technology to deliver the required high data rates largely depends on the amount of spectrum that can be harnessed for use.[25] However, existing wireless allocations are insufficient to meet future needs.[26]

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[25] The wireless industry largely agrees that significant additional spectrum allocations are needed and soon. In 2006, the ITU concluded that by 2020, 1280 to 1720 MHz of additional spectrum will be needed to support both 2G/3G and 4G technologies. *See* ITU, *Estimated spectrum bandwidth requirements for the future development of IMT-2000 and IMT–Advanced*, Report ITU-R M.2078 (2006) (based on the market projections from 2010 onwards of a variety of external organizations), *available at* http://www.itu.int/publ/R-REP-M.2078/. T-Mobile has suggested that the Commission reclaim and repurpose a portion of the broadcast spectrum for wireless broadband services because broadcasters do not require the entire amount of their allocated spectrum to meet their projected needs. *See,* Comments of T-Mobile USA, Inc., GN

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In addition, many of the current wireless mobile allocations are based on 5 MHz, or less, blocks of spectrum, which are block sizes that are generally sufficient to support existing services. Some technologies, like LTE, will support more feature-rich and data intensive services in these block sizes.[27] Ultimately, larger contiguous blocks of appropriate spectrum better support advanced consumer demand for capacity hungry applications because 4G technologies, like LTE and LTE–Advanced, are optimized over wider bandwidths.[28] For this reason, the Commission must strive to allocate new licensed spectrum for mobile services in wider bandwidths.

Even if the U.S. were to immediately allocate more suitable spectrum for mobile services, wireless providers would, nevertheless, face capacity difficulties in the coming decade.[29] To address these capacity challenges, wireless providers will need to manage their networks more dynamically to stretch scarce network resources as far as possible. Intelligent and efficient equipment within the core and RAN network, "smarter" user devices, and more advanced network management tools will all be necessary to manage capacity constraints that are inherent in wireless networks. Further, providers will increasingly need to rely on differentiation of traffic

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(footnote continued)
Docket 09-51 *et al.* (filed Dec. 22, 2009) *available at* http://fjallfoss.fcc.gov/ecfs/comment/view?id=6015503881. Ericsson supports this view.

[26] Julius Genachowski, Chairman, FCC, *America's Mobile Broadband Future*, Remarks at International CTIA Wireless I.T. and Entertainment (Oct. 7, 2009), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-293891A1.pdf ("Counting last year's 700 MHz auction, the FCC in recent years has authorized a 3 fold increase in commercial spectrum. The problem is many anticipate a 30-fold increase in wireless traffic.").

[27] LTE supports flexible carrier bandwidths, from 1.4 MHz up to 20 MHz. *See* Ericsson White Paper, *LTE—an Introduction*, at 3 (June 2009), *available at* http://www.ericsson.com/technology/whitepapers/lte_overview.pdf.

[28] LTE–Advanced can support bandwidths up to 100 MHz. *See* Stefan Parkvall, *et al.*, Ericsson Research, *LTE–Advanced—Evolving LTE towards IMT–Advanced* (March 2009), *available at* http://www.ericsson.com/technology/research_papers/wireless_access/doc/VTC08F_jading.pdf

[29] Historically, it has taken about 10 years to identify and allocate spectrum suitable for wireless services.

by "class" (*e.g.*, application category) and tailor the treatment of a specific class of traffic according to its QoS requirements to provide the best performance possible out of their networks for consumers.

Technology is evolving in precisely this direction. For LTE, the Third Generation Partnership ("3GPP") has standardized a streamlined QoS concept that is specifically designed for the Evolved Packet Core system ("EPC") in order to allocate network resources more efficiently based on the needs of the application.[30] QoS in LTE relies on a network-initiated QoS-control paradigm rather than a terminal-initiated paradigm.[31] There are several advantages to network-initiated QoS control because services such as Internet access and IMS voice are typically provided by the access network provider through peering arrangements with third party service providers. Network-initiated QoS is a better approach for allocating resources because it is aware of, and takes into account, what else is occurring in the network when assigning resources.

Another advantage of the QoS control paradigm specified in EPC is that it can tailor the handling a particular class of applications according to the packet loss, packet delay, and minimum guaranteed or non-guaranteed bit-rate requirements of that class. It achieves this by establishing a single resource assignment or "bearer" for each application based on its QoS Class

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[30] See 3GPP Release 8, *available at* http://www.3gpp.org/Release-8 (last visited Jan. 9, 2009).

[31] 3GPP Release 8 envisions both terminal-initiated and network-initiated QoS paradigms. In the case of a terminal-initiated QoS request, the terminal signals the network to set up a dedicated bearer with specific QoS characteristics communicated from the end-user's terminal to the network. Both the terminal and the application in question must be aware of the particular QoS specifics inherent in the network. In a network-initiated paradigm, the network initiates a signal to set up a bearer with specific QoS to the end-user's terminal and the RAN. Network-initiated control can provide QoS to access "agnostic" client applications, such as those that are downloaded and installed by end users.

Identifier ("QCI"), a number that specifies the QoS needed for the traffic.[32] The QCI is used within the access network as a reference to node-specific parameters that control packet forwarding treatment. This approach allows the network to process different types of traffic based on their differing QoS needs.

This categorization of traffic, together with the network-initiated QoS control paradigm, gives providers a more precise mechanism for effectively managing the QoS they provide to users. For example, network-initiated QoS control centralizes exception handling policies. When a service initiation request is rejected, the network must take action to either give up or to retry the connection a specified number of times or with a lower QoS. Network-initiated QoS allows for more consistent application of policies because this functionality is in the network rather than distributed among numerous terminals from multiple vendors.

Management tools, such as QoS in the EPC system, also enable wireless providers to utilize their finite spectrum resources to deliver multi-service offerings, like multimedia telephony services and mobile-TV, that have different required bit rates, acceptable packet delay levels, and sensitivity to variations in network performance. Thus, as both the number of mobile broadband subscribers contending for network resources and the traffic volume per subscriber intensifies—which is the case today—management tools, like QoS, enable providers to allocate network re-

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[32] There are 9 standardized QCI labels that establish the priority, maximum packet delay budget, and packet loss rate for different classes of service at both guaranteed and non-guaranteed bit rates. For example, some classes are highly sensitive to delay and loss, such as real-time gaming (QCI=3 or 7) and live streaming voice (QCI=1 or 7) or video (QCI=2 or 7) applications. Other classes (QCI=6, 7, or 9) apply to less sensitive Internet usage categories, including web browsing, email, file transfer, and p2p file sharing. *See* 3GPP Release 8, Policy and Charging Control Architecture, v.8.8.0, TS 23.203, at 30 (Table 6.1.7, Standardized QCI Characteristics) (Dec. 2009), *available at* http://www.3gpp.org/ftp/Specs/archive/23_series/23.203/23203-880.zip. In addition, network operators may establish their own custom QCI labels.

sources in a more systematic, fair, and efficient manner that improves the overall performance of the network and availability of enhanced services for all users.

2. Cable Networks Have Capacity Constraints Due to Their Shared Nature

Network management is also needed in cable networks to distribute shared capacity and overcome congestion caused by periods of high demand. In cable networks, the upstream channel is shared by multiple users, and services are delivered according to a best-effort paradigm. Consequently, any one source of traffic can take an unfair share of the available network resources, resulting in degraded service for everyone else. This is especially true in the context of upstream capacity because cable systems were not designed with upstream communications in mind. Network management techniques help cable providers distribute network capacity among all users and improve overall performance.

When the number of users and the amount of information they wanted to transmit began to increase, cable providers looked for ways to augment the capacity available to each individual user of the shared resource. DOCSIS 3.0 grew out of these efforts and enables cable providers to combine several upstream channels—bonding them together—so that they can increase the overall amount of available capacity.[33] DOCSIS 3.0 is an important innovation that makes better use of the cable facilities already deployed.[34] But, even with this advance, cable providers, just like the wireless providers discussed above, still need to utilize management tools to distribute their capacity in a fair and appropriate way.

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33 By using a statistical multiplexing scheme on these bonded channels, cable providers can give each user access to a greater pool of capacity than if they were sharing a single upstream channel as was the case before DOCSIS 3.0 was implemented.

34 For example, the DOCSIS specifications allow cable networks to integrate telephony and Internet access into cable television service and offer added features such as greater interactivity and Video on Demand. *See generally* CableLabs, DOCSIS®, http://www.cablemodem.com.

Looking forward, the capacity pressures on cable networks will continue to grow. Video, which is the fastest growing driver of traffic on cable networks, requires substantially more bandwidth than browsing web-pages or VoIP.[35] HD video will cause bandwidth usage to escalate even more. Accordingly, as with other network platforms, cable networks will need to rely on a variety of network management tools, including those that enable prioritization, to guarantee packet delivery and protect the overall robustness of the network.

D. All Network Management Tools—and Especially Those that Are Standardized or Widely Used—Should Be Considered Presumptively Reasonable

As described above, network management is integral to fairly distributing network capacity and providing quality services to all consumers. Network management is a common, accepted engineering practice that is embedded at every level of a network to optimize its performance. Therefore, as described below, the Commission's policy should start from the presumption that all management techniques are reasonable, and that standardization or widespread usage is strong evidence in favor of reasonableness.[36] This pragmatic approach appropriately acknowledges that management techniques are important to a consumer's communications experience and are needed to dynamically allocate network resources based on demand.

Ericsson encourages the Commission to employ a two-part test in evaluating, on a case by case basis, whether an objecting party has demonstrated that a specific management practice is unreasonable. Specifically, Ericsson suggests that the Commission consider whether there is a

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35 *See* Rysavy Report at 6.

36 Ericsson cautions the Commission against taking the alternate approach—delineating specific management techniques it deems to be reasonable. As networks evolve, so too will the universe of reasonable management tools and any "laundry list" of reasonable network management techniques is susceptible to being outdated before it is even completed. Further, establishing a checklist of permitted tools thwarts innovation and the evolution of the broadband ecosystem.

factual showing that a management tool has significantly harmed consumers and has had significant anticompetitive effects. If a network provider uses a network management tool in a way that does not harm consumers overall and that is not anticompetitive in fact, there is no valid reason for restricting or limiting its use.

1. Standardization or Widespread Acceptance as Evidence of Reasonableness

Standardization and widespread acceptance are reliable indicators of reasonableness. Many network management tools have been vetted through numerous standards bodies like the Internet Engineering Task Force ("IETF"), the Institute of Electrical and Electronics Engineers, Inc. ("IEEE"), the Alliance for Telecommunication Industry Solutions ("ATIS"), and 3GPP, among others. These organizations represent a broad cross section of the communications industry and their standards take into account input from a wide array of technical experts from various disciplines.

Through the standards deliberation processes, these organizations consider the propriety of technical solutions designed to solve real engineering, networking, and service delivery challenges. Proposed solutions that are unreasonable unworkable, inappropriately advantage or disadvantage one technology or application over others, or are otherwise objectionable are rejected. As a result, these organizations play a central role in obtaining industry coalescence around the most practical and least overall harmful solutions to engineering obstacles.

Standardization through formal bodies is not the only powerful evidence of reasonableness. Some tools may be in wide use in networks throughout the world before they have been fully considered by standards bodies or may be based on proprietary technology. The widespread use of a particular tool or technology should be admissible to rebut claims that it is an unreasonable network management technique. The Commission can (and should) rely on the efforts of standards bodies and industry expertise and make it clear that standardization or widespread acceptance is strong evidence of the reasonableness of a particular network management tool.

2. Case-by-Case Analysis of Significant Harm to Consumers and Anticompetitive Effects is Necessary

When considering allegations that a network management practice is unreasonable, the Commission should consider whether the practice has been shown to have significantly harmed consumers and to have had significant anticompetitive effects. A case-by-case analysis is necessary to avoid the problem that prescriptive regulations would create. When a network management practice is challenged, the Commission should narrowly consider whether the *particular* management tool is unreasonable in a *particular* situation, based on relevant facts. This approach ensures that the Commission does not issue overbroad, blanket prohibitions of management tools that have legitimate and reasonable uses.[37]

As discussed above, under certain circumstances, it may be appropriate to limit a particular user or type of user in order to ensure better service for consumers at large, just as a traffic signal requires some motorists to wait while others can go. In both cases, these management tools serve to regulate the efficient flow of traffic so that pile-ups do not occur and delays are minimized. Consequently, these management techniques benefit, rather than harm, consumers as a whole, even though some individuals are temporarily delayed or inconvenienced. For this rea-

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[37] Throttling and packet inspection are good examples of management tools that have very valid uses to improve traffic flow and provide the QoS required for the satisfactory performance of particular types of applications. Such tools will likely have even greater value as traffic loads on networks continue to grow.

son, the Commission must consider whether a management tool harms consumers in the aggregate, not just an individual consumer.

Further, the Commission should not prohibit or discourage the use of legitimate network management tools merely because of the hypothetical possibility that a tool could be used anti-competitively. Nor should the Commission presume anticompetitive conduct just because a network provider who offers a service that competes with one offered by an unaffiliated source deploys a legitimate network management action that affects the broadband Internet access over which the unaffiliated service is delivered. If providers are uncertain about what actions they can or cannot take to manage their networks, they may refrain from innovating or using management techniques that allow them to improve network performance for *all* customers.

A case-by-case analysis of how a specific management tool is used in a specific situation is the best approach to defining unreasonable management techniques.[38] This approach appropriately balances the Commission's obligations with its goals of maximizing the potential of broadband networks and providing greater predictability to all members of the broadband eco-system.

II. MANAGED SERVICES

A. In an All-IP World, Providers' Traditional Services Are Tomorrow's Managed Services

In the traditional view of communications networks, various electronic communications services were synonymous with the "physical layer" over which they were delivered.[39] Almost

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[38] Ericsson does not address whether the Commission actually has the authority to engage in such regulation. *See supra* note 3.

[39] In the seven-layer OSI model of networking, the lowest layer is known as the physical layer. It is in this layer that the shapes and properties of the electrical connectors, the modulation

(continued on next page)

by definition, twisted pair copper cabling meant interconnected voice telephony, coaxial cable meant one-way video, and two-way wireless signals meant cellular voice. Similarly, the devices used on those networks were also synonymous with the particular communications service: televisions simply displayed video delivered via cable or over the air, cell phones enabled two-way voice calls, and wireline phones enabled local and long-distance telephone calls.

In today's new paradigm, regardless of the nature of the "physical layer," these traditional services, such as full-motion live video and real-time voice communication, are increasingly delivered over a much higher level IP "application layer."[40] Thus, the offerings of the traditional telephone company are no longer defined by the network over which it offers services; nor is the cable provider's service offering dictated by the fiber and cable facilities it uses. Instead, as networks move to IP, traditional services (*e.g.*, two-way voice and full-motion live video) will become managed applications on the provider's network.[41] Similarly, as wireless carriers the world over adopt 4G wireless broadband technologies, voice becomes another application delivered wirelessly using IP, rather than the *raison d'être* of the network itself.

(footnote continued)
schemes, and similar low-level parameters are specified. *See* Visual Networking Overview—The OSI Model, http://compnetworking.about.com/od/basicnetworkingconcepts/l/blbasics_osimod.htm.

[40] In the TCP/IP model, the Application Layer refers to higher-level protocols used by most applications for network communication, and relies on lower-level protocols to provide a stable network connection across which to communicate. *See* Microsoft TechNet, *TCP/IP Protocol Architecture*, http://technet.microsoft.com/en-us/library/cc958821.aspx.

[41] The Commission has sought comment on the transition from a circuit-switched telephone network to an all-IP network. Public Notice, *Comment Sought on Transition from Circuit-Switched Network to All-IP Network*, GN Docket 09-47 *et al.*, NBP Public Notice #25, DA 09-2517 (Dec. 1, 2009), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-09-2517A1.pdf. There was strong support from telephone companies for the phase-out of circuit-switched POTS. *See, e.g.*, Comments of AT&T, GN Docket 09-47 (filed Dec. 21, 2009). *See also* "Cable Operators Shift Toward IPTV While Deploying Tru2way," COMM. DAILY, Nov. 2, 2009, at 6-7 ("But senior cable officials showed much more enthusiasm for the much-anticipated switch to IPTV. Several of them openly embraced the idea of upgrading their video delivery systems to all-IP platforms over the next few years.").

The applications mentioned above, as well as others that are in development, are not the same as the multitude of applications available to consumers over the open Internet. What distinguishes these applications, and what leads to innovation in optimizing existing bandwidth-constrained networks, is the use of network management tools to deliver the QoS that consumers expect and demand from a stand-alone network.[42] These existing applications are generally delivered today over a virtual "pipe" from a provider to a consumer, which is separate from the consumer's general broadband Internet access service. Most managed services are delivered this way today but there is no technological reason that they could not be delivered using the network resources devoted to a consumer's broadband Internet access.

B. The Commission Should Not Subject Managed Services *Internet Policy Statement* Principles or Other Rules Absent a Showing of Significant Harm to Consumers and Anticompetitive Effect

The Commission has asked whether and how any of the rules it proposes to codify to govern broadband Internet access ought to apply to managed services offerings.[43] As noted above, Ericsson does not support the codification of the four principles set forth in the Commission's *Internet Policy Statement* or the additional rules proposed in its *NPRM*. If the Commission adopts rules nonetheless, Ericsson urges the Commission to exclude managed services offerings from such rules.

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[42] *See* ATIS, IPTV Interoperability Forum, http://www.atis.org/PRESS/cutsheet/Atis_iiF_cut_2.pdf (November 2008) ("In contrast to video over the public Internet, with IPTV deployments network security and performance are closely managed to help ensure a superior entertainment experience resulting in a compelling business environment for content providers, advertisers and customers alike."); *See* Ericsson White Paper, *Personalized and Interactive TV Enabled by IMS,* at 7 (Sept. 2008), *available at* http://www.ericsson.com/technology/whitepapers/IMS_TV_4.pdf ("IMS together with a Multi Access Edge solution gives operators control of end-to-end QoS and service delivery to each and every user. This allows operators to prioritize and adapt QoS parameters according to the kind of device and service being used.").

[43] *See NPRM* at ¶ 152.

Managed services are increasingly demanded from both an investment and user perspective. Building, maintaining, and updating wireless, cable, and fiber networks to keep pace with consumer demand is a massive capital endeavor. To attract and make the needed investment, providers and investors require a level of confidence that network investments will yield some reasonable return in the future. To do this, providers must be able to make use of the networks they build to provide a multitude of services in addition to broadband Internet access service. Such services will undoubtedly compete with services offered over a broadband Internet access service subject to reasonable network management practices. However, as the entities making the primary investments in network infrastructure, providers should have the commercial freedom to offer differentiated services.[44]

A primary goal of the Commission's National Broadband Plan proceeding is to encourage the deployment, modernization, and expansion of network infrastructure. So long as consumers get the broadband Internet access services they pay for, what providers do with the rest of their network capacity should not be regulated or restricted in any way. The Commission should not apply either the four principles set forth in its *Internet Policy Statement* or any "nondiscrimination" or "transparency" rules to managed services because managed services serve a valuable purpose in meeting subscriber needs and are an important way for providers to recoup their in-

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44 The Commission should not assume that simply because a network operator offers a service that competes with other services with whom the operator has no relationship, the operator is acting anticompetitively by offering its service as a managed service with a high level of service quality, when others' services offered over the public Internet are available on a best efforts basis. In fact, today, one sees competition in the video space over cable companies' own networks. They offer on-demand managed video services, but customers are also free to connect laptops and other dedicated devices—including some HDTVs—to the high-speed cable modem service and watch programming from broadband Internet sources outside of the cable operator's managed video offering. For example, Netflix allows users to watch movies on a host of devices. *See* NETFLIX, TV Episodes and Movies—Instantly to Your TV, http://www.netflix.com/NetflixReadyDevices (last visited Jan. 9, 2010).

frastructure investments. The Commission should only consider subjecting managed services to the principles or rules applicable to broadband Internet access if it determines, based on a full factual record, that a given managed service offering in a particular context has caused significant harm to consumers and has caused significant anticompetitive effects.

Moreover, managed services are desired and valued by consumers. First, in an all–IP network, managed services preserve the high quality service experience customer's enjoyed over traditional dedicated networks. Second, assigning priorities to different communications enables new offerings, including services that demand specific levels of security and data integrity. For example, in the future, a subscriber using a home heart monitoring service could dedicate a certain portion of his broadband Internet access to the heart monitoring application. In this way, the user could assign a higher priority to his heart monitor traffic than to all other traffic on his broadband Internet access connection and thereby ensure that these critical information packets are not delayed by his son's video streaming taking place over the same connection. Similarly, a business might demand priority delivery to its employees of data generated by mission-critical applications.

C. Managed Services in the Wireless Broadband World

An excellent example of a wireless managed service offering *today* is Wireless Priority Service ("WPS"). Provided in times of emergency, WPS strives to ensure that designated personnel—first responders, for one example—are moved to the top of the allocation queue for network resources. In the future, there will be countless other wireless managed services.

3GPP Rel. 8 (LTE) envisions a wireless network paradigm in which voice is just one of many managed services available to consumers. In 3GPP Rel. 8, all data—*including the carrier's own voice service*—are transmitted over "bearers" to the end-user's terminal (an air card, an LTE phone, etc.).[45] A bearer identifies unique packet flows for common QoS treatment and IP addresses over a network. Thus, one device could have two bearers assigned at the same time for two services requiring different QoS levels—for example, voice and video. Similarly, one device could have two bearers assigned at the same QoS level, but for two different IP addresses—for example, the terminal could be a multiple access point that supports two separate video streams delivered simultaneously to different end users at the same location.

By using unique bearers, providers are able to specify certain minimum quality standards for applications. This is done using the same or similar tools as are used for QoS network management. Bearers have certain attributes associated with them that define their QoS characteristics, referred to as the QCI.[46] In 3GPP Rel. 8, there are two types of bearers: guaranteed bit-rate (GBR) and non-GBR.[47] A provider might choose GBR bearers for applications where the preferred user experience is "service blocking over service dropping" (*i.e.*, the preferred situation is to block a service request entirely rather than risk poor performance of an already active applica-

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[45] *See* Hannes Ekström, *QoS Control in the 3GPP Evolved Packet System*, 47 IEEE Communications, Issue 2 at 77 (Feb. 2009) ("*QoS Control*"), *available at* http://archive.ericsson.net/service/internet/picov/get?DocNo=5/287%2001-FGB%20101%20256&Lang=EN&HighestFree=Y. A bearer is the basic enabler for traffic separation in a network based on 3GPP Release 8 (*i.e.*, an LTE network), where traffic is separated according to different QoS requirements.

[46] *See supra* note 32 and accompanying text.

[47] Today, some networks, like HSPA networks, utilize Asynchronous Transfer Mode (ATM) data transmission technology. ATM transport supports four different bearers: Constant bit rate (CBR); Variable bit rate (VBR); Available bit rate (ABR); and Unspecified bit rate (UBR).

tion).[48] On the other hand, a non-GBR bearer can remain established for long periods of time because it does not block transmission resources.[49]

Another way to use QoS to offer managed services over LTE is to make use of the maximum bit-rate (MBR) feature. MBRs can be specified for different bearers. MBRs are particularly useful in the corporate virtual private network construct. For example, an employer could specify an MBR of 100 Mbps for a bearer dedicated to a corporate VPN and an MBR of 5 Mbps for public Internet access. In this way, the employer can allocate more network resources to those applications critical to an employee's job functions. A residential subscriber might also enjoy a similar setup, where certain network access points—such as those that are used by the children—are assigned a lower level of bandwidth and priority than those used by the parents. Alternatively, different applications, such as file-transfer applications, could be granted lower bandwidth or lower priority than others.[50]

D. The Commission Should Foster Innovative Managed Services Offerings

As broadband networks and applications evolve, managed services that employ a portion of the bandwidth from the customer's broadband Internet access service, instead of separate dedicated bandwidth, may proliferate. Such services may provide a better overall user experience than if the customer were to rely on best-effort Internet for the same purpose. As with the heart monitoring example discussed above, a user could allocate some of his purchased broad-

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48 The telephone network employs this "service blocking over service dropping" approach. For example, in certain situations—such as calling on Mother's Day—it may not be possible to meet all requests with the dimensioned capacity in a given area. However, those calls that do go through should not drop in the face of the high demand.

49 *See QoS Control* at 77-78.

50 In addition, both network-initiated and terminal-initiated QoS can be employed in managed services, but just as discussed above in the context of network management. Terminal-initiated QoS presents greater challenges. *See supra* note 31.

band Internet access service especially for a managed health monitoring service. Similarly, a customer might want to purchase a managed Internet HD video service that utilizes a specially managed, specific portion of his purchased bandwidth (and leaves the remainder free for all other uses) because the customer finds that without a specially managed service, the quality of HD video over the Internet is unpredictable.

The ability of companies to offer managed services in this way has distinct consumer advantages. Using a managed service that benefits from QoS at both ends of the communication can have a positive effect on the rest of the services available. Moreover, the service can be managed so that when it is not in use, the bandwidth it requires is freed up for other Internet services on a dynamic, real-time basis. Because these types of service arrangements are providing increasing value to consumers, the Commission should take care to foster their development.

CONCLUSION

The broadband ecosystem is constantly evolving in terms of technology, consumer demands, and capacity. The fact that the broadband ecosystem is dynamic and highly competitive is its core strength. Providers' ability to innovate enhanced products and services to address new market opportunities is what draws investment and drives the expansion of broadband networks.

So as not to upset the regulatory balance that has brought so many communications advances to date, Ericsson cautions the Commission not to codify either the four principles set forth in its *Internet Policy Statement* or the "nondiscrimination" or "transparency" rules proposed in its *NPRM* for all access technologies, but especially for wireless networks. Wireless networks are capacity limited by the finite spectrum resources available and require a plethora of management techniques in order to ensure a quality experience for subscribers.

Rather than adopting rules, Ericsson recommends that the Commission provide further clarification about how to distinguish permissible reasonable network management practices from "unreasonable" management practices. Specifically, Ericsson proposes that the Commission make clear that: (a) all network management practices will presumptively be considered reasonable, especially those that are standardized or widely used; and (b) the party objecting to a network management practice must demonstrate factually, on a case by case basis, that it has caused significant harm to consumers and has had a significant anticompetitive effect.

In addition, Ericsson recommends that the Commission hold that providers' managed services offerings are presumptively permissible and not subject to any principles or rules applicable to broadband Internet access. This approach allows the Commission to protect the public interest and promote investment in broadband technologies and services. It will also enable Ericsson, and other companies in the broadband ecosystem, to continue to innovate to empower people, businesses, and society.

Respectfully submitted,

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